

ABSTRACT

A self-replicating monolayer system employing polymerization of monomers or nanoparticle ensembles on a defined template provides a method for synthesis of two-dimensional single molecule polymers. Systems of self-replicating monolayers may be used as templates for the growth of inorganic colloids. A preferred embodiment is a SAM-based replication, wherein an initial monolayer is patterned and used as a template for self-assembly of a second monolayer by molecular recognition. Once the second monolayer has formed, it is polymerized in place and the two monolayers are separated to form a replicate. Both monolayers may then function as templates for monolayer assemblies. A generic self-replicating monomer unit suitable for use in one embodiment comprises a polymerizable moiety attached by methylene repeats to a recognition element and an ending unit that will not interfere with the chosen recognition chemistry. The recognition element is self-complementary, unless a set of two replicating monomers with compatible cross-linking chemistry is employed. In a two-component replication system utilizing two different kinds of recognition chemistries, the initial template undergoes replication cycles, while maintaining the two-dimensional segregation of the two types of monomers. During subsequent replications, the component domains experience little or no mixing, allowing the two-component, patterned assembly to be exponentially replicated. After replication, selective mineralization and/or electroless plating may produce a two-dimensional inorganic sheet having patterned domains within it.